

Research Article

Treatment of Torus Palatinus: An Overview

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Received: 02 March, 2025 : Accepted: 03 April, 2025 : Published: 09 April 2025

Abstract:

Torus is a non-pathologic exostosis that develops from a localized cortical bone protrusion in the oral cavity. The prevalence of torus palatinus varies from 9% to 60% with predilection for females, with multifactorial etiology. Torus removal or torectomy procedures aim to restore orofacial physiologic function and/or allow placement of rehabilitative prosthetics without risk of harm. Surgical methods for torus removal include traditional methods that use burs, bone chisels, and mallets to remove the bone protrusion; laser surgery, particularly with erbium-doped yttrium aluminum garnet (Er:YAG) lasers, which are less invasive; and piezoelectric surgery, which uses ultrasonic vibrations to cut bone with high precision while protecting soft tissue and causing the least amount of damage to surrounding tissue.

Key words: Torus Palatinus, Torus Removal, Palatal exostoses, Laser ER: YAG, Piezoelectric

Introduction

Torus in the oral cavity is a non-pathologic exostosis originating from a localized protrusion of cortical bone. These exostoses develop through a process of hypertrophy of the compact bone layer and sometimes of the cancellous bone layer. The torus palatinus, or in plural referred to as tori, is a benign bony protrusion of the maxillary hard palate that usually appears in the midline area. Most tori palatini are small, with less than 2 cm in diameter, but may change over time.[1][2]

The prevalence of torus palatinus varies from 9% to 60% with a predilection for females. The etiology of torus palatinus is multifactorial, and can be associated with autosomal dominant genes.[2] Thirty percent of torus variation is related to hereditary factors, while the other 70% is thought to be influenced by environmental factors. Environmental factors must reach a certain threshold before they can be expressed in genes.[1] According to Gregson et al (2020) there is an association between rare variations and mutations in the Suppressor of Mothers against Decapentaplegic 9 (SMAD 9) gene and very high bone density phenotypes, including the appearance of torus palatinus.[3]

Torus removal or commonly termed as torectomy procedures aim to restore orofacial physiologic function and/or allow placement of rehabilitative prosthetics without risk of harm.[4] The objective of this article is to provide a better understanding of torus palatinus, including anatomical consideration of surrounding structures, indication, surgical preparation, choice of approach to surgical management, and complication of the surgical procedures.

Discussion

Torus palatinus appears as a hard-bony mass protruding at the midline sutural portion of the hard palate. Torus palatinus can be classified based on its morphology including flat, spindle

shape, nodular, and lobular torus (Figure 1). Flat torus has a broad and slightly convex base, with a smooth surface, extending symmetrically to both sides of the midline raphe of the palate. Spindle shaped torus has a ridge along the palatal raphe, and sometimes there is a groove in the midline of the torus. Nodular torus appears as multiple protrusions, with individual bases on each protrusion. These protrusions may merge and form grooves in between the nodules. Lobular torus, which is a multilobulated mass, but has one common base. The torus may or may not have a stalk.[2][5][6]

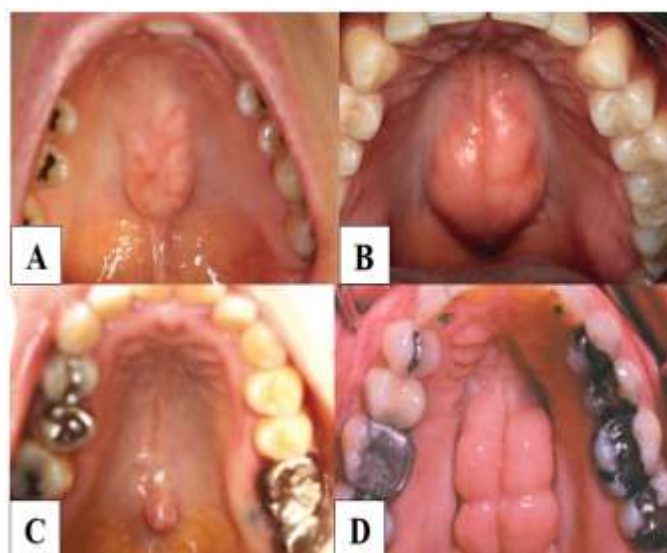


Figure 1: Morphology of Torus Palatinus: Flat torus (A) Spindle shaped torus (B) Nodular torus (C) Lobular torus (D)[5][6]

In some literature, it is mentioned that the torus can be an efficient marker in increased bone mass phenotypes and hyperparathyroidism. The torus can also be used to address intraosseous defects in periodontitis and is more effective than a full-thickness flap. Torus is used for vertical ridge

augmentation in implant cases and can be used as autogenous graft material for sinus lifting and dental implant procedures.[1] In most cases, the torus does not need to be removed. But in some conditions the torus needs to be surgically removed. The indications for surgical removal of the torus palatinus include speech impairment, masticatory dysfunction, chronic trauma to the surface of the torus, food retention and hygiene issues, difficulty in constructing a stable removable prosthesis, torus with deep undercuts and multiple nodules, torus that crosses the border of the palatal region, and psychological problems of the patient (carcinophobia).[2] Contraindications to surgical removal of the torus include the general contraindications of the preprosthetic surgery, including patients with medical compromise; patients with a history of head and neck irradiation in the near future; bone disorders such as osteoporosis, hyperparathyroidism, etc.; patients on bisphosphonate therapy who have a risk of osteochemonecrosis, where bisphosphonates can induce apoptosis of osteoclasts by inhibiting farnesyl diphosphate synthase, causing suppression of bone resorption and bone remodeling. Bisphosphonates are often used for the treatment of patients with osteoporosis, bone metastases in malignant tumors (breast cancer, prostate cancer, and lung cancer), and multiple myeloma.

Anatomical Consideration of Torus Palatinus

The palatal mucosa is innervated by the nasopalatine nerve, the greater palatine nerve in the anterior direction, and the lesser palatine nerve palatine in the posterior direction (Figure 2). The greater palatine nerve descends through the pterygopalatine canal towards the hard palate through the greater palatine foramen which is usually located about 1 cm from the midline of the palate. The nerve lies between the mucoperiosteum and bone, and innervates the soft tissues of the palate and bone until around the area of the first premolar, then connects with the fibers of the nasopalatine nerve anteriorly. This nerve also innervates a portion of the soft palate. The middle palatine nerve exits the lesser palatine foramen along with the posterior palatine nerve. The middle palatine nerve innervates the mucous membrane of the soft palate, while the posterior palatine nerve innervates the tonsillar region.[7]

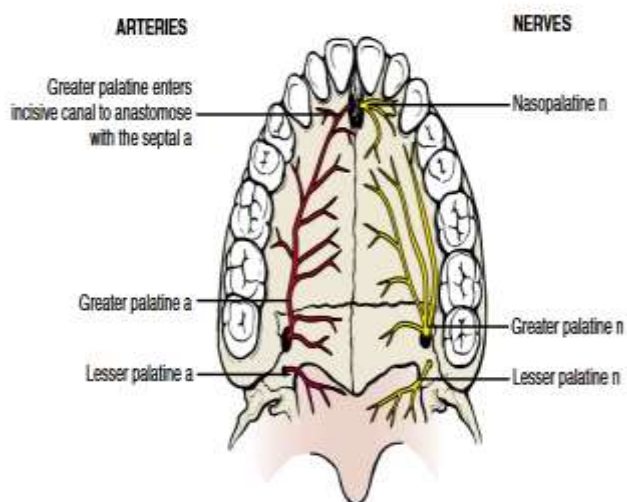


Figure 2: Innervation and vascularization of palate.

The arterial supply of the palate region comes from the descending palatine artery which is a branch of the maxillary artery within the pterygopalatine fossa (Figure 2). This artery runs in the palatine canal and branches into the greater palatine artery which exits through the greater palatine foramen on both sides of the palate in the area near the maxillary second molar. The second branch of the lesser palatine artery exits through the lesser palatine foramen. The veins of the palate adjoin its arteries and drain into the pterygoid plexus which located in the infratemporal fossa, and the lymphatic drainage from the palate drains to the deep cervical nodes.[8]

At the midline of palatine suture, the bone thickness is ≥ 6 mm, and 6-10 mm lateral to the sutura, the thickness decreases to ≤ 3 mm. Computed tomography scan (CT-Scan) or cone-beam computed tomography (CBCT) images can provide accurate images of the torus dimensions, especially to determine the height and distance of the torus from the nasal floor. This can allow the operator to avoid perforating the palate bone.[6]

Surgical Removal of Torus Palatinus

The torus removal procedure has 2 essential phases, the mucosal phase, and the bony phase. Four main types of incisions can be made depending on the location and morphology of the palatal torus, including a simple linear incision, Y incision, double Y incision, and double curvilinear incision with a long anteroposterior axis bordering the mucosal surface in an elliptical shape. Recommended techniques for palatine torus removal include a straight incision on the torus with a Y-shaped releasing incision in a full thickness palatal flap (Figure 3).[2][4]

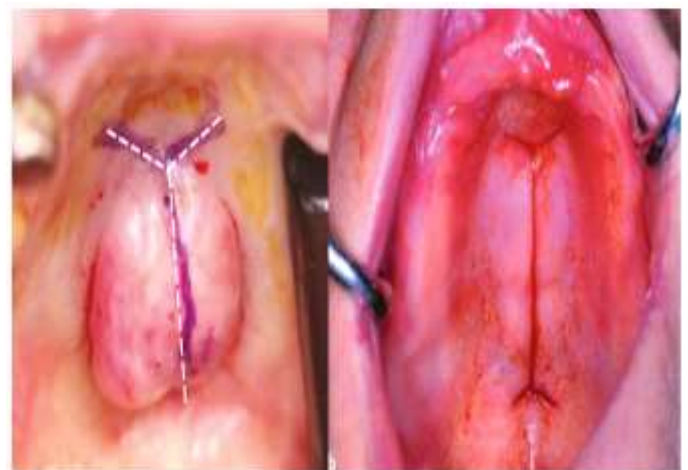


Figure 3: Y-shaped incision (left) and double Y-shaped incision (right) on torus removal procedure.[6][9]

The surgical technique of torus removal can be performed using several approaches, including conventional surgical techniques using bur, bone chisel, and mallet to excise the bone protrusion; laser surgery, especially using erbium-doped yttrium aluminum garnet (Er:YAG) laser, which is a more minimally invasive alternative for the management of torus removal; and piezoelectric surgery with piezoelectric devices using ultrasonic vibrations to cut bone with high precision while preserving soft tissue and minimizing damage to surrounding tissue.[10][11][12]

In the torus removal surgical procedure, after local anesthetic

block of both greater palatine nerve and nasopalatine nerve, a linear incision is made in the anteroposterior direction in the midline of the palate, then a Y-shaped release incision is made at one or both ends of the linear incision. Both mucoperiosteal flaps are reflected with periosteal elevators from the midline to both sides of the incision. Retraction sutures are placed on both flaps to optimize flap opening and expose the torus.

It is important to note that the torus palatinus should not be excised en masse due to its proximity to the nasal floor structures. It may cause perforation into the nasal cavity causing oronasal communication. In conventional torectomy surgical procedures, division of the torus into multiple segments is performed using a bur (vertical and horizontal multiple cuts) (Figure 4). Small segments are removed using a chisel and mallets, then using a large round bur, smoothing of sharp bony areas is performed. Excess soft tissue is trimmed and sutured using absorbable thread with an atraumatic needle. An acrylic splint may be placed or an iodoform pack tied over the surgical area to prevent hematoma.[10][9]

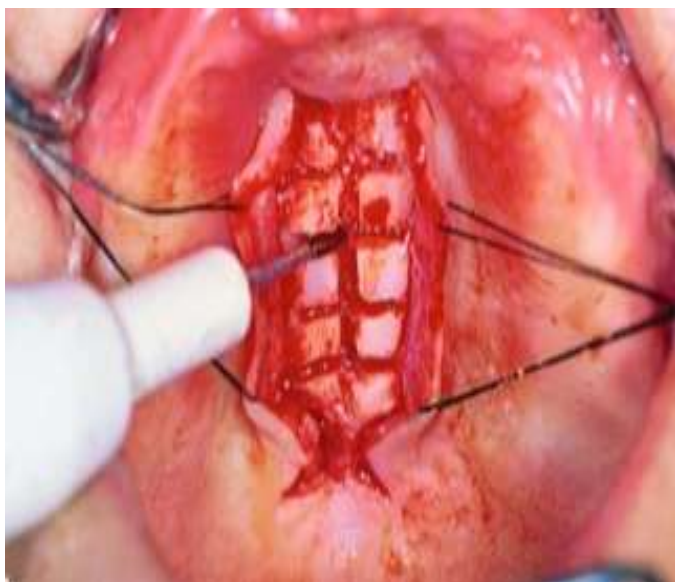


Figure 4: Division of torus into some smaller segment using fissure bur.[9]

In the surgical procedure of torus removal with Er:YAG laser, Er:YAG laser was prepared with parameters of output power 450 mJ, frequency 20-30 Hz, sapphire tip diameter 1.2 mm, pulse duration 150 μ sec, fluence 39808.91 J/cm² air-water ratio 5/5, pulse number 12702 associated with (30 shots/sec) 421.4 sec, slightly more than 7 minutes of working time. In the torectomy procedure using Er:YAG laser (explosive vaporization), there was no bone cutting with a bur as in the conventional method. After the mucoperiosteal flap is reflected, laser is performed on the left side followed by the right side of the torus. Each shot/pulse removes a small portion of bone. The bone surface will be irregular after Er:YAG laser application, so a bone rasp/bone file is required to smoothened the bone surface. In addition, in Er:YAG laser torectomy surgery (explosive vaporization), it is not possible to take samples for histopathological examination.[11]

In torectomy surgery using a piezoelectric device (PED), the torus is divided into several segments using fissure bur as in conventional technique, then the torus segment is excised using

the OT8 tip, which is a PED tip with a saw-shaped blade, followed by recontouring the bone surface using the OT9 tip.[12][13]

Postoperative instructions are given to avoid complications in the post operative wound healing process, such as giving analgesics and education to maintain oral hygiene to facilitate healing. Then the patient was instructed to control one week and 8 weeks after surgery for evaluation.[14] Possible complications of the torus palatinus removal procedure include intraoperative and postoperative complications. Intraoperative complications include bleeding due to greater palatine blood vessel injury which can occur during mucoperiosteal release, there is a risk of tearing of the palatal mucosal attachment and greater palatine blood vessel injury, most located at the border of the torus palatinus. Fracture of the palatal shelf and oroantral/oronasal perforation may also occur. This can be avoided by performing a CT scan or CBCT examination to see the vertical dimension and thickness as well as the proximity of the torus structure to the base of the nasi cavum. In small nasal perforations, flap closure can be performed, where the incision line should be above the healthy bone. Whereas in larger perforations, a 2-layer closure (oral mucosa and nasal mucosa) will be easier to perform with easier access to the nasal mucosa. Another intraoperative complication is bone necrosis due to overheating of the bur. To prevent osteonecrosis, irrigation with water coolant is performed during the drilling process. Post-operative complications include hematoma, palatal mucosal necrosis, oroantral/oronasal fistula, suture separation, and infection.[4][6][10][14][15]

Conclusions

The surgical removal or torectomy procedure of torus palatinus is a surgical procedure that can be performed using conventional surgical methods or with Er:YAG laser and piezoelectric devices. Each technique has its own advantages and disadvantages. Toretomy surgery on the torus palatinus should not be performed en masse due to its proximity to the nasal cavity and has a high risk of oronasal communication if performed carelessly. The bone obtained from the torectomy procedure can be used as graft material for other dentoalveolar surgical procedures.

Ethics approval and consent to participate

Not applicable

List of abbreviations

If abbreviations are used in the text they should be defined in the text at first use, and a list of abbreviations should be provided.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

Authors' contributions

All authors were major contributors in writing the manuscript. All authors read and approved the final manuscript.

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